

### **REMARKS/ARGUMENTS**

Claims 1-46 and 73-81 are pending in this application. Nos. 14, 15, 19, 20, 39-42, 45, 46 and 76 are withdrawn by the Examiner from further consideration as being directed to a non-elected invention. Nos. 1-13, 16-18, 21-38, 43-44, 73-75 and 77-81 are presently under examination and have been rejected.

In this response, the two independent claims under examination, i.e., nos. 1 and 23, have been amended to recite that the ratio between the amount of carbohydrates (claim 1) or oligosaccharides (claim 23), or of the carbohydrate (or oligosaccharide) mixture to be oxidized and the amount of gold present on the support is more than 1,000. Support for these amendments is found on p. 19, line 23 to p. 20, line 3 of the present specification, as well as in original claims 10 and 23. Claims 10 and 23 have, accordingly, been cancelled from the application without prejudice or disclaimer due to the amendment to claims 1 and 23 described above.

No new matter is added by the proposed claim amendments and their entry is, therefore, respectfully solicited. Upon entry of the proposed amendments, claims 1-9, 11-33, 35-46 and 73-81, as amended, will be pending in the application. Of these, nos. 1-9, 11-13, 16-18, 21-33, 35-38, 43-44, 73-75 and 77-81 are under examination. Reconsideration of the subject claims is requested.

### **Rejection Under 35 U.S.C. §103**

The Examiner continues to maintain the rejection under 35 U.S.C. §103 of claims 1-13, 16-18, 21-38, 43-44, 73-75 and 77-81 over Biella et al. (Journal of Catalysis) in view of U.S. Patent No. 4,985,553 to Fuertes et al., and Biella et al. (Catalysis Today). The rejection is respectfully traversed.

The cited references, together with the features of the presently claimed method which are believed to distinguish over the combined disclosure of the references, have been extensively discussed in applicants' responses previously filed in this application. Those remarks are expressly incorporated by reference into this discussion.

One of the distinguishing aspects previously raised by applicants is that the metal oxide-supported gold catalysts recited for use in the presently claimed method exhibit an unexpectedly high activity and greater durability than the carbon-supported gold catalysts taught for use by

Biella et al. A declaration under 37 C.F.R. §1.132 of co-inventor Dr. Alireza Haji-Begli was, in fact, submitted with applicants', "Response to Final Office Action" filed June 25, 2009 in an effort to provide evidentiary support for the applicants' position. Applicants have argued, furthermore, that the surprising and unexpected improvement offered with the use of the presently claimed catalysts in oxidizing carbohydrates (claim 1) or oligosaccharides (claim 23), or mixtures of the same, or compositions having a content thereof, supports applicants' contention that the present claims are not obvious over the combined disclosure of the cited prior art to one having at least an ordinary level of skill in this field.

In the Advisory Action, however, the Examiner refers to applicants' arguments in support of the contention that the claimed catalysts are more effective/durable than the carbon supported gold catalysts used in the prior art and raises (see Advisory Action, pp. 2-3) several objections to what she perceives are deficiencies in the comparison(s) submitted by the applicants between the two 'types' or 'forms' of catalysts.

In response, submitted herewith is a "Second Declaration Under 37 C.F.R. §1.132 of Dr. Alireza Haji-Begli. The subject declaration has been prepared and is offered herein in response to the Examiner's objections, referred to above, to Dr. Haji-Begli's first such declaration as set forth in the Advisory Action. This new declaration details the results obtained with a series of experiments carried out by Dr. Haji-Begli, or under his direction and control, comparing the results obtained with the claimed metal oxide-supported gold catalysts against those obtained with the use of carbon-supported gold catalysts according to the prior art. As stated in paragraph 4 of the subject declaration, the Experiments were carried out under the same conditions as utilized by Biella et al. (Journal of Catalysis) at a controlled pH of 9.5. As further explained, e.g., in paragraphs 5 and 6, Tables 1 and 2 provided with the declaration demonstrate the catalysts according to the present claims reach 100% conversion within 15 minutes, which corresponds to double the "activity" (defined as the degree of conversion/time) than was achieved with the catalysts of Biella et al. Additionally, the declaration further demonstrates that the significantly higher activity achieved with the use of the claimed catalysts remains unchanged following 10 repeated batches. In each batch, a complete conversion of glucose was obtained after no more than 20 minutes. The conversion rates achieved in each of the different batches are shown in Table 1 provided with the declaration. In contrast to the values shown in the case of applicants' catalysts, the loss of activity demonstrated by the catalysts according to

Biella et al. is significant, even at pH = 9.5. As shown in the declaration, the activity of the Biella et al. catalysts is 2.5 fold lower after four runs than after the initial run. The results set forth in the subject declaration thus, in applicants' view, clearly demonstrate to one having at least an ordinary level of skill in the relevant art that the catalysts according to the presently pending claims exhibit an unexpectedly higher and greater durability in contrast to the Biella et al. catalysts. Further, this unexpected superiority is believed to serve as direct evidence that the method recited in the claims under examination in the present application is not obvious over any method suggested by the combination of references relied upon by the Examiner to reject applicants' claims.

Further to the above applicants have previously raised the issue that the prior art in the field of the present invention, at the time the presently claimed method was developed, evidenced a strong prejudice against the use of metal oxide, rather than carbon, as a support for gold catalysts. In support of this contention, applicants have previously supplied the Examiner with portions of a text, *Fine Chemicals through Heterogeneous Catalysis*, edited by Sheldon et al. which, applicants contend, provide a 'teaching away' from the substitution of metal oxide-based gold catalysts for carbon-based gold catalysts, which the Examiner has, in contrast, held would be an "obvious" matter.

Further in support of the applicants' contention, i.e., as to the prejudice exhibited in the art at the time of the present invention against the use of metal oxide-supported gold catalysts, applicants are providing herewith portions from an additional reference, i.e., Prati et al., *Studies in Surface Science and Catalysis*, pp. 509-516 (1997). As shown by the reference, the authors investigated the chemoselective catalytic oxidation of polyols (i.e., carbohydrates are polyols) with dioxygen in the presence of supported gold catalysts. Page 513 of the reference, following Table 1, it states that the influence of the support on the gold-catalyzed oxidation (of ethane-1, 2-diol) is very relevant. Furthermore, in Table 2 on the same page, the metal oxide-supported gold catalysts exhibit a significantly lower selectivity (almost two-fold) toward the oxidation of a polyol (ethane-1, 2-diol) as compared to carbon-supported gold catalysts. Thus, the reference would serve to lead one having an ordinary level of skill in this art to believe that metal oxide-supported gold catalysts have a much poorer selectivity than carbon-supported gold catalysts, when used in the oxidation of polyols.

The subject reference is listed on the form attached to this Amendment and the Examiner is respectfully requested to consider the reference and make it of record in this application by initialing and dating the form and providing a copy thereof to applicants' representative with the next Office Communication concerning this application. No fee is believed to be due for this submission since this Response is being filed together with a Request for Continued Examination and the required fee therefor. Should any additional fee be required, however, authorization is hereby provided to charge the required amount to our Deposit Account No. 15-0700.

Further with regard to the subject Prati et al. reference, applicants submit for the Examiner's information that the subject reference was published in 1997, which is earlier than the 2002 publication of Biella et al. (*Catalysis Today*). Prati is, moreover, a named co-author of both of the Biella et al. references. One having at least an ordinary level of skill in this art thus would have considered that the later experiments detailed in the Biella et al. references were based on the knowledge and results concerning the experiments detailed in the Prati et al. reference provided herewith. In the 1997 studies, Prati did not utilize metal oxide supported catalysts. The results obtained in the oxidation of ethane-1, 2-diol, as set forth in Prati et al., thus motivated the researcher(s) toward the use of carbon-supported gold catalysts in the future experiments. Accordingly, therefore, it can reasonably be said that at the time the presently claimed methodology was developed, one having at least an ordinary level of skill in this field was not motivated to use metal oxide-supported gold catalysts.

Applicants' contention above, i.e., that the art at the time the present invention was developed did not suggest the use of metal oxide-supported gold catalysts, is further supported by the Sheldon et al. reference previously submitted to the Examiner since Sheldon et al. teaches that carbon supports are superior to metal oxide supports under all reaction conditions. In particular, the subject reference recommends (see p. 516, lines 1-2) the use of carbon supported catalysts due to their stability in acidic and chelating media [note: glucose and other carbohydrates were known to be molecules having a high tendency toward chelation].

Further to the above, applicants reiterate that claims 1 and 23 of their application have been amended to recite therein the ratio of the substrate (i.e., carbohydrate/oligosaccharide) to gold, as originally recited in claims 10 and 34, respectively, being  $\geq 1,000$ . In Prati et al. and in Biella et al., the ratio between the substrate (e.g., glucose) and the amount of gold present on the metal oxide support is no more than 1,000 [see, e.g., Biella et al., *Catalysis Today*, Table 11;

Biella et al., *J. of Catalysis*, p. 243, right-hand column, line 1]. The Prati et al. reference additionally discloses that the selectivity of a 1% carbon-supported gold catalyst is 98% if the substrate to metal (gold) ratio is 100, while the selectivity drops to 90% if the ratio is higher than 100, i.e., such as the ratio of 1000 in Table 4. One having at least an ordinary level of skill in this art thus learns from Prati et al. that the optimum substrate to metal ratio is about 100 and, when the ratio is increased, the selectivity accordingly decreases. Thus, such an individual would certainly not be motivated by the disclosure contained in the prior art to increase the substrate to metal ratio to a value > 1,000, i.e, which is the value now recited in applicants' independent claims 1 and 23.

In contrast to the teachings contained in the prior art, therefore, the metal oxide-supported gold catalyst recited in applicants' present method claims surprisingly enables the highly selective and efficient production of acids formed from carbohydrates (including oligosaccharides), even at substrate to metal ratios > 1000. Furthermore, as pointed out above and demonstrated in the Second Declaration Under 37 C.F.R. §1.132 of Dr. Alireza Haji-Begli, the catalysts for use in the claimed method additionally demonstrate unexpectedly higher activity and durability than the catalysts as taught by the combined disclosure of the references cited to reject applicants' claims.

### **Summary**

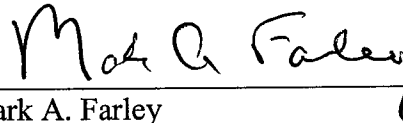
Applicants respectfully submit that the claim amendments and arguments provided above, taken in conjunction with the evidence contained in the §1.132 declaration of the co-inventor submitted herewith, serve to distinguish the claimed method from the combination of references cited to reject the pending claims under examination. The Examiner is, thus, requested to reconsider and withdraw the rejection under 35 U.S.C. 103 of applicants' claims and to issue a Notice of Allowance for all of the claims under examination.

If the Examiner does not agree and believes that an interview would advance the progress of this application, she is respectfully invited to telephone applicants' representative at the number below in order that such an interview may be scheduled.

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MAF:ck

Respectfully submitted,

A handwritten signature in black ink that reads "Mark A. Farley". The signature is written in a cursive style with a long horizontal line extending from the end of the name.

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